

PIPE DISCONNECTING APPARATUS

This is a division of patent application Ser. No. 467,158, filed May 6, 1974 now U.S. Pat. No. 3,957,113 entitled PIPE DISCONNECTING APPARATUS.

This invention relates to apparatus for disconnecting pipe sections which are disposed at a relatively remote location. More particularly, this invention relates to improvements in apparatus for disconnecting an upper from a lower section of a pipe string extending within the bore of an underwater wellhead. In one of its aspects, this invention relates to improvements in apparatus of this type which also contains the pressure within the well, both prior and subsequent to the disconnection of the upper and lower sections of the pipe string.

In the drilling of underwater wells, weather conditions may require that an upper section of a pipe string, such as a string of drill pipe to which a drill bit is connected, be disconnected from its lower section to permit it to be removed with a drilling vessel from which the string is suspended. More particularly, it is necessary to disconnect the string at the level of the blowout preventer stack of the wellhead, so that, when it is disconnected, the bore through the wellhead may be closed by rams of a preventer in the stack. This, however, cannot be done by the usual equipment on a drilling vessel, because it is impossible to predict which joint of the string will be "backed off." Also, time does not permit the string to be raised and disconnected, stand by stand, as is done in the ordinary drilling procedure.

It has therefore been proposed to shear the drill string by means of one or more blades mounted for reciprocation within guideways extending outwardly from the bore through the wellhead. More particularly, a pair of blades are preferably mounted on "blind" rams of a blowout preventer, which have seal portions arranged to seal off with one another and with respect to the guideway, when the drill pipe has been sheared and its sheared ends are moved to positions out of the way of the inner ends of the rams. Thus, these rams serve to close off the well bore, either when there is no pipe in the bore or following shearing of the drill string.

Ordinarily, such a preventer also includes "pipe" rams mounted for reciprocation in guideways beneath the blind rams and adapted to close off the bore about the lower section of the drill string, either before or after it has been sheared. In order to avoid attempting to shear the string at a tool joint, it is the preferred practice, in preparing to use apparatus of this type to shear a drill string, to lift the string, move the pipe rams inwardly about the string, and then lower the string to permit the lower end of the tool joint immediately above the pipe rams to seat on their upper surfaces.

This practice of shearing the drill string presents problems when drilling of the well is to be resumed. For one thing, small pieces of the drill string may break off from it adjacent its sheared edges, thereby leaving "junk" in the hole. Also, in reentering the well, it's necessary to perform complicated and time-consuming milling and fishing operations to prepare the cut edges of the upper end of the lower section to receive an upper extension thereof.

An object of this invention is to provide apparatus which permits the upper section of the pipe string to be disconnected from the lower section at the level of the wellhead, without the problems encountered with the above-described prior apparatus and thus without the risk of junking the hole or the necessity for preparing

the cut edges of the upper end of the lower section of the drill string.

Another object is to provide such apparatus which, similarly to the prior apparatus above described, contains the pressure within the well both prior and subsequent to the disconnection of the sections of the drill string.

A further object is to provide such apparatus which is relatively inexpensive to manufacture and easy to operate.

These and other objects are accomplished, in accordance with the illustrated embodiment of this invention, by apparatus which is adapted to disconnect the upper pipe section from the lower pipe section by backing off the lower threaded end of the upper section from the upper threaded end of the lower section at the desired joint between them. For this purpose, it comprises a housing which is adapted to be connected as a part of the wellhead, with its bore aligned with the bore of the wellhead to receive the pipe string, and which has at least one guideway extending outwardly from the bore to receive a ram for movement toward and away from the bore. In accordance with the present invention, the drill string is supported and held against rotation with the lower threaded end of its upper section opposite the ram guideway, and the ram is provided with means arranged to grippingly engage and move along a side of the upper section, and thereby exert a force thereon tending to rotate it about its axis, as the ram is moved in one direction.

Preferably, the housing has oppositely disposed guideways extending from its bore, each for receiving a ram of the type described. This not only multiplies the force with which the upper section is caused to rotate, but also enables each ram to act as a back-up for the side of the pipe section opposite that engaged by the other ram, thereby preventing bending of the unsupported upper end of the lower pipe section. Furthermore, and as will be described below, the lower pipe section is preferably held by means disposed a short distance beneath the ram guideways.

Each ram includes a carrier guidably movable in the guideway, and a jaw mounted on the carrier for longitudinal movement with it toward and away from the bore of the housing. The jaw has a cam surface which is slidable over a cam surface on the carrier, and a toothed surface which is arranged to be wedged by the cam surfaces into gripping engagement with and movement along the side of the upper pipe section, as the carrier moves in one longitudinal direction. Preferably, a spring engages the jaw and carrier to yieldably urge the jaw into a position in which its toothed surface is so arranged.

The drill pipe sections making up a drill string are connected by tool joints whose threads are held with a compressive force which is substantially relieved by rotating one end only a fraction of a revolution with respect to the other. Thus, only one traverse of the rams may be required to back the upper drill pipe section off from the lower drill pipe section a sufficient extent to permit their complete disconnection and separation by means on the drilling vessel. In any event, however, the jaw surfaces are so arranged that, upon movement of the rams in the opposite direction, the toothed surfaces are relieved from gripping engagement with the upper section, whereby the carrier may be returned to a position from which it may again be moved for exerting force on the upper pipe section. Consequently, in the